PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference 93581-123PCT	**FOR FURTHER ACTION**	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)
International application No. PCT/CA 02/01681	International filing date *(day/month/year)* 01.11.2002	Priority date *(day/month/year)* 01.11.2002
International Patent Classification (IPC) or both national classification and IPC G06T15/10		
Applicant CAE INC. et al.		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 8 sheets, including this cover sheet.

   ☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

   These annexes consist of a total of 1 sheets.

3. This report contains indications relating to the following items:

   - I ☒ Basis of the opinion
   - II ☐ Priority
   - III ☒ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - IV ☒ Lack of unity of invention
   - V ☒ Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
   - VI ☐ Certain documents cited
   - VII ☐ Certain defects in the international application
   - VIII ☐ Certain observations on the international application

Date of submission of the demand	Date of completion of this report
05.04.2004	07.02.2005
Name and mailing address of the international preliminary examining authority: European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Casteller, M Telephone No. +49 89 2399-2666

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No. PCT/CA 02/01681

I. Basis of the report

1. With regard to the **elements** of the international application *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17))*:

Description, Pages

1-26	as originally filed

Claims, Numbers

1-11	as originally filed
12-15	received on 18.01.2005 with letter of 17.01.2005

Drawings, Sheets

1/4-4/4	as originally filed

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

   These elements were available or furnished to this Authority in the following language: , which is:

   ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).

   ☐ the language of publication of the international application (under Rule 48.3(b)).

   ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

   ☐ contained in the international application in written form.

   ☐ filed together with the international application in computer readable form.

   ☐ furnished subsequently to this Authority in written form.

   ☐ furnished subsequently to this Authority in computer readable form.

   ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

   ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

   ☐ the description, pages:

   ☐ the claims, Nos.:

   ☐ the drawings, sheets:

5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

   (Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

   ☐ the entire international application,

   ☒ claims Nos. 13-15

   because:

   ☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):

   ☒ the description, claims or drawings *(indicate particular elements below)* or said claims Nos. 13 are so unclear that no meaningful opinion could be formed *(specify)*:

   see separate sheet

   ☒ the claims, or said claims Nos. 13 are so inadequately supported by the description that no meaningful opinion could be formed.

   ☐ no international search report has been established for the said claims Nos.

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

   ☐ the written form has not been furnished or does not comply with the Standard.

   ☐ the computer readable form has not been furnished or does not comply with the Standard.

IV. Lack of unity of invention

1. In response to the invitation to restrict or pay additional fees, the applicant has:

   ☐ restricted the claims.

   ☒ paid additional fees.

   ☐ paid additional fees under protest.

   ☐ neither restricted nor paid additional fees.

2. ☒ This Authority found that the requirement of unity of invention is not complied with and chose, according to Rule 68.1, not to invite the applicant to restrict or pay additional fees.

3. This Authority considers that the requirement of unity of invention in accordance with Rules 13.1, 13.2 and 13.3 is

☐ complied with.

☐ not complied with for the following reasons:

4. Consequently, the following parts of the international application were the subject of international preliminary examination in establishing this report:

☒ all parts.

☐ the parts relating to claims Nos. .

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-12
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-12
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-12
	No:	Claims	

2. Citations and explanations

see separate sheet

Re Item III

Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The amendments filed with the letter dated 17.01.2005 introduce subject-matter which extends beyond the content of the application as filed, contrary to Article 34(2)(b) PCT.
Claim 13 as originally filed recited that the colour values of the pixels ("data points") may be replaced by "digital information". As CLPs are not even mentioned in claims 13 to 15, the claimed "data points" can only be interpreted as pixels.
Claim 13 as presently on file has been amended to additionally recite that said "digital information" is indicative of the result of a visibility test carried out for each pixel, and that the pixel colour values are replaced by said "digital information" following this visibility test.
The applicant has argued that these amendments to claim 13 would be supported by claims 1 to 4 and by the description, but this does not appear to be the case.
Claim 1 in fact sets out that the colour portion of CLPs, not that of the pixels, is replaced with "digital information" and that this is done before any visibility test, not as a result thereof.
The description also does not support the operated amendments, as it discloses that:
each CLP datum transmitted to the GPUs is made up of 3D coordinates and of a CLP identifier (e.g. a sequence number) stored in the colour portion of the CLPs (cf. e.g. page 17, lines 1-11);
it is determined if each given CLP is occluded, the determination being based on a comparison of Z values (page 17, lines 20-23);
in dependance from the above determination, said "digital information", i.e. the identifier of each give CLP, is transmitted over a local bus to an occlusion counter 225 (page 17, lines 24-30; page 18, lines 22-29).

2. Consequently, independent claim 13 violates the requirements of the PCT, as it includes subject-matter extending beyond the content of the application as filed (Articles 34(2)(b) PCT), said subject-matter not being supported by the description (Article 6 PCT).

Re Item IV

Lack of unity of invention

3. This International Preliminary Examination Authority found multiple (groups of) inventions in this international application, as follows:

   First Invention, claims: 1-12: a system and method for rendering CLPs (calligraphic light points) in a 3D-to-2D mapping. The colour portion of the CLPs is replaced by "information" identifying each given CLP, said information being "returned" as an indication of occlusion/visibility of the CLPs to an occlusion counter. The counted values are used to control the display characteristics of the CLPs.

   Second Invention, claims: 13-15: a graphical processing unit for 3D-to-2D mapping of data points. It is again noted that since CLPs are not even mentioned in these claims, the claimed "data points" can only be interpreted as pixels.
   According to this invention as claimed, and insofar it can be understood, a GPU carries out a visibility test for each pixel (i.e. "data point"), whereby the colour portion of each tested pixel is replaced by "information" indicating the test result, said information being (somehow) used to store the pixels.

4. The description makes clear that 3D objects (i.e. 3D polygonal scene elements) are completely rendered, whereby conventional Z-buffering techniques are used to determine the objects visibility in the 2D display. Only thereafter (cf. e.g. page 16, lines 25-27), CLP rendering is carried out as above outlined, and as recited in claims 1-12.
   Whereas the first invention is only and exclusively concerned with efficient rendering of CLPs, the second invention only deals with pixel rendering in 3D-to-2D mapping. As the rendering of 3D objects is separate from (i.e. it precedes) the rendering of the CLPs, the two invention are logically and functionally distinct from each other.
   The application thus relates to a plurality of inventions, or groups of inventions, in the sense of Rule 13.1 PCT.

Re Item V

Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

5. **First Invention, claim 1-12**

5.1 Reference is made to the following documents:

D1: GB-A-2 265 801 (REDIFFUSION SIMULATION LTD) 6 October 1993 (1993-10-06)
D2: EP-A-0 507 550 (GEN ELECTRIC) 7 October 1992 (1992-10-07)

5.2 Documents D1 and D2 represent the prior art closest to the subject-matter of claim 1 to 12.

D1 discloses an image generator e.g. a flight simulator (page 1, lines 1-4) wherein a number of parallel processors (page 9, lines 15-21) perform the mapping of 3D objects to the 2D display space (page 11, lines 17-23). After said 3D objects have been rendered in a raster image, calligraphic light points, hereinafter CLPs, are processed (page 70, lines 19-25). At each sampling point, CLPs are rendered taking into account of any possible occlusion by translucent objects nearer to the viewing point than the CLP, so that CLPs can be attenuated; the combined attenuation are stored in a weighting and accumulation device 93 (page 71, lines 8-16).

D2 describes a method for resolving occlusion in a combined raster-scan / calligraphic display system (cf. title). 3D objects are rendered first using conventional Z-sorting (abstract; column 5, lines 40-47). The rendering of CLPs is then performed (column 5, lines 37-52), whereby the occlusion relationship amongst CLPs is checked and accumulated in a subpixel record (column 6, lines 26-58). In a final stage, raster scan data of the rendered 3D objects is combined with the accumulated CLP data, again taking into account of their distance from the viewing point (column 7, lines 7-41).

5.3 Neither D1, nor D2, nor any other available document discloses the (2D) rendering of 3D objects and of CLPs, wherein the colour portion of the CLPs data can be replaced by digital information (which identifies each respective CLP), said digital information being involved in the calculation of CLPs occlusion state, as outlined above and as recited in independent claims 1 and 10.

Consequently, the subject-matter set out in present claims 1 to 12, and particularly in

independent claims 1 and 10, is considered to be novel and non-obvious with respect to the disclosures of the available prior art. It is also evident that the invention is industrially applicable.

The requirements of paragraphs (1) to (4) of Article 33 PCT are thus met.

12. A method as claimed in claim 10 wherein the step of displaying comprises displaying the CLP over an underlying two dimensional graphical display to provide increased intensity to the display at the coordinates corresponding to the CLP.

13. A graphical processing unit (GPU) adapted to map three-dimensional data points to a two-dimensional display space, each data point containing a respective color value,

wherein the GPU is further adapted to determine whether each data point is visible with respect to a fixed point in front of the two dimensional display, and replace the respective color value with digital information indicative of the determination result,

whereby the mapped data points may be stored according to the digital information.

14. A graphical processing unit (GPU) as claimed in claim 13, wherein the GPU comprises a commercially available unit adapted to perform three-dimensional raster image processing.

15. A graphical processing unit (GPU) as claimed in claim 13, wherein the GPU is adapted to operate in a first mode in which the digital information indicates when the respective data point is visible with respect to the fixed point and a second mode in which the digital information indicates when the respective data point is not visible with respect to the fixed point.